Kazuo OGINUMA* & Ryuso TANAKA**: **Karyomorphological studies on three species of *Myrica***

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Of the member of *Myrica* two species are known to occur native in Japan. *Myrica rubra* occurs commonly in evergreen broad-leaved forests of warm temperate regions of Japan and also in North Korea, China and Formosa. *M. gale* var. *tomentosa* grows in moors in high lands of Honshu and Hokkaido of Japan (Ohwi 1978, Kitamura & Murata 1979) and is distributed in East Siberia, the Kuriles and Sakhalin. The genus *Myrica* is regarded as one of the groups belonging to Amentiferae and has been studied systematically to elucidate the origin of apetalous dicotyledon. Though the chromosome numbers have been reported in some species of the genus, further karyomorphological studies on the genus are needed to make clear the interrelationships among species of the genus *Myrica*.

The present study deals with karyotype analysis of two Japanese species of *Myrica*, in comparison with *M. cerifera* from North America and *M. gale* var. *gale* from Europe.

Materials and methods Two plants of *Myrica rubra* Sieb. et Zucc. were collected from Miyajima Is. in Hiroshima Pref. and Kochi City in Kochi Pref. One plant of *M. gale* L. var. *tomentosa* C. DC. was collected from Sarobetsu Moor in Hokkaido Dist. That of *M. cerifera* L., North American species, was obtained from the Hiroshima Botanical Garden. Seeds of *M. gale* L. var. *gale* were obtained from the Dahlem Botanical Garden in West Germany, and they were germinated in the experimental garden of the Faculty of Science, Hiroshima University. The materials and their sources were listed in Tab. 1. For the taxonomical treatment of the Japanese materials the opinion of Ohwi (1978) was followed in the present study.

For the observations of somatic chromosomes, the young leaves of shoot

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Tab. 1. Chromosome numbers and sources of *Myrica* investigated.

Taxa	Sources	No. of plants observed	Present counts 2n	Previous reports 2n (n)
M. rubra Sieb. et Zucc.	Miyajima Is., Hiroshima Pref.	1	16	(8) Sugiura '27
	Kochi City, Kochi Pref.	1	16	
M. gale L. var. *tomentosa* C. DC.	Sarobetsu, Hokkaido Dist.	1	48	48 Sokolovskaya '60 96 Löve & Löve '75
M. cerifera L.	Hiroshima Bot. Gar.	1	16	16 Stokes '37
M. gale L. var. *gale*	Dahlem Bot. Gar., West Germany	1	48	(24) Hagerup '41 96 Taylor & Mulligan '68

apex were used. The treatment for preparation was made by the method of Tanaka & Oginuma (1980).

Observations Many mitotic cell divisions were observed in the young leaves. Observations of resting and mitotic chromosomes were carried out in the epidermal cells and meristematic cells of young leaves, respectively.

1) *Myrica rubra* Sieb. et Zucc. Chromosomes in the resting nuclei formed chromatin threads, many chromomeric granules and several chromocentral blocks scattered in nuclear space. The chromocentral blocks varied in number from 12 to 8 per nucleus, and were ellipsoidal or round in shape with about 0.6 μm-0.3 μm in the major axis. The surface of chromocentral blocks was not clearly delimited (Fig. 1A). The morphology of chromosomes at resting stage was categorized to be the simple chromocenter type defined by Tanaka (1971, 1980).

At mitotic metaphase the chromosomes were counted to be $2n=16$ in two plants. This confirmed the previous report (Sugiura 1927). The longest chromosome of the complement was about 2.3 μm, and the shortest was about 1.4 μm. The length variation from the longest chromosome to the shortest of the complement was gradual. The centromeres of all chromosomes of the complement were found to be located in median position (Figs. 1B, 2A, B). The chromosome complement showed the symmetric karyotype in arm ratio. The chromosome with secondary constriction was not observed.

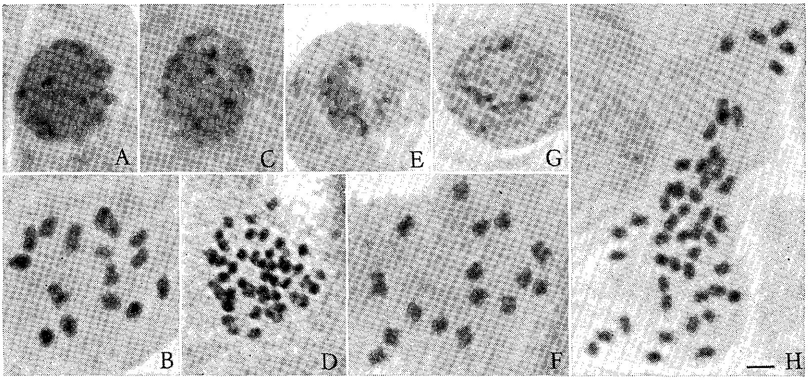

Fig. 1. Somatic chromosomes in four taxa of *Myrica* at resting stage (A, C, E, G) and at mitotic metaphase (B, D, F, H). A, B: *M. rubra* (2n=16). C, D: *M. gale* var. *tomentosa* (2n=48). E, F: *M. cerifera* (2n=16). G, H: *M. gale* var. *gale* (2n=48). Bar indicates 2 μm.

2) *M. gale* L. var. *tomentosa* C. DC. The morphological characteristics of chromosomes at resting stage was found to be similar to that of the previous species, except the high number of chromocentral blocks from 14 to 12 per nucleus (Fig. 1C), and thus it belongs to the simple chromocenter type as seen in the foregoing species.

At metaphase the chromosomes were 2n=48. This confirmed the previous report of Sokolovskaya (1960). The longest chromosome was about 1.1 μm and the shortest was about 0.5 μm. The chromosomes of the complement showed the gradual variation in length. Large and medium-sized chromosomes of the complement had the centromere situated in median position (Fig. 1D). The chromosome with secondary constriction was not observed.

3) *M. cerifera* L. The morphological characteristics of resting stage (Fig. 1E) resembled those of *M. rubra* described in entry 1. Hence, the morphology of the resting chromosomes was categorized to be the simple chromocenter type.

Chromosomes at metaphase were 2n=16, the number of which confirmed the previous report (Stocks 1937). The variation of chromosome length and the position of the centromere resembled those of *M. rubra*. However, secondary constrictions were observed in the proximal regions of short arms of a pair of the longest chromosomes (Figs. 1F, 2C, D).

4) *M. gale* L. var. *gale*. The morphological characteristics of the resting stage (Fig. 1G) were similar to those of *M. gale* var. *tomentosa* described in

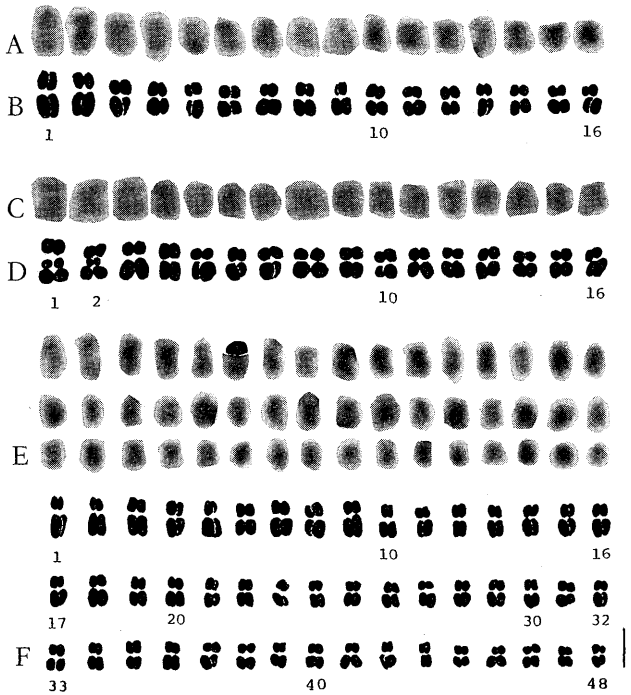

Fig. 2. Photomicrographs (A, C, E) and drawing (B, D, F) of somatic chromosomes at mitotic metaphase in three species of *Myrica*. A, B: *M. rubra* (2n=16). C, D: *M. cerifera* (2n=16). E, F: *M. gale* var. *gale* (2n=48).

entry 2, and the morphology of the resting chromosomes was categorized to be the simple chromocenter type.

Chromosomes at metaphase were 2n=48, the number of which confirmed the previous report (Hagerup 1941). The variation of chromosome length and the position of the centromere (Figs. 1H, 2E, F) resembled those of *M. gale* var. *tomentosa*.

Discussion The genus *Myrica* consists of about 56 species (Melchior 1964, Cronquist 1980, and others). Among the species, the chromosome numbers have been reported to be 2n=16, 2n=48 and 2n=96 in ten species, indicating that there is the polyploid series with the basic number x=8 in *Myrica*, *i.e.*, 2n=16 is diploid, 2n=48 is hexaploid and 2n=96 is dodecaploid. In the present study both *M. rubra* and *M. cerifera* were found to be diploid with 2n=16, both *M. gale* var. *tomentosa* and var. *gale* were found to be hexaploid with 2n=48. However, 2n=96 in *M. gale* var. *tomentosa* (Löve & Löve 1975) and var. *gale* (Taylor & Mulligan 1968) has been reported. This indicates that an intraspecific polyploidy occurs in *M. gale*.

From the karyomorphological view point, the two diploid species, *M. rubra* of Japan (Fig. 2A, B) and *M. cerifera* from North America (Fig. 2C, D), are considered to be related in respect to the morphology of metaphase chromosomes with the exception of chromosomes with secondary constriction observed only in *M. cerifera*. In hexaploid species, *M. gale* var. *gale* from Europe, chromosomes of the complement varied gradually in length and had the median centromere. Secondary constriction was not observed in this species (Fig. 2D, F). Japanese hexaploid, *M. gale* var. *tomentosa* showed almost the same karyotype as that of *M. gale* var. *gale*. In addition to this, the resting chromosomes of four taxa were observed to be the same simple chromocenter type with several ellipsoidal or round chromocenters. In respect to the presence of the chromosomes with secondary constriction, there has been karyomorphological differentiation between the North American diploid species *M. cerifera* and the Japaeese diploid species *M. rubra*. Both Japanese hexaploid *M. gale* var. *tomentosa* and European hexaploid *M. gale* var. *gale* seem to be derived from such diploid plant as *M. rubra* which has the chromosome complement without secondary constriction, because there was no secondarily constricted chromosomes in the two hexaploids species.

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本邦産ヤマモモ *Miryca rubra* とヤチヤナギ *M. gale* var. *tomentosa* 及び北米産 *M. cerifera* と欧州産 *M. gale* var. *gale* との核形態学的研究を行ない，次の結果を得た。染色体数は *M. rubra* と *M. cerifera* は共に 2n=16 (二倍体)，*M. gale* var. *tomentosa* と var. *gale* は共に 2n=48 (六倍体) であった。これらはすべて，静止期染色体が単純染色中央粒型，分裂期中期染色体が勾配的染色体長及び対称的腕比で互いに類似していた。しかしながら，二次狭窄染色体は *M. cerifera* の1対の最長染色体の短腕基部でのみ観察された。このような核形態学的特質から，本邦産二倍体ヤマモモと北米産二倍体 *M. cerifera* とは核型的に分化していることがわかった。また，*M. gale* var. *tomentosa* と var. *gale* の核型は互いに類似し，これらの核型は，ヤマモモのように染色体組中に二次狭窄をもたない二倍体から起源した六倍体と推察された。

□西沢一俊：**ワカメが高血圧も成人病もハネ返す** 191 pp. 1986. 主婦の友社，東京. ¥690. 最近健康食品として海藻が見なおされ，海藻食品や海藻の健康維持への効能などについて幾つかの小冊子が出版されているが，正直言って満足させてくれる内容の本は極めて少なかった。本書は主な対象が家庭の主婦ということもあって，題名や記述はかなりくだけたものとなっているが，内容は科学的根拠に裏付けられており，教えられるところが多い。高血圧や動脈硬化あるいは脳卒中の予防になぜ海藻がよいか，制ガン効果があると言われるがそれはなぜか，多量に含まれるミネラルが健康によいのはなぜかなど，海藻成分と成人病あるいは美容等との関係が人体生理学や薬理学の立場から，長寿村の調査例，臨床実験例，成分表などを混えてわかりやすく解説される。栄養面から海藻の活用をはかりたい人や海藻一般に興味をもつ人によい参考書となるだろう。

(千原光雄)